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Online stochastic weighted matching: Improved approximation algorithms.

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Summary: Motivated by the display ad allocation problem on the Internet, we study the online stochastic weighted matching problem. In this problem, given an edge-weighted bipartite graph, nodes of one side arrive online i.i.d. according to a known probability distribution. Recently, a sequence of results by Feldman et. al [14] and Manshadi et. al [20] result in a 0.702-approximation algorithm for the unweighted version of this problem, aka online stochastic matching, breaking the $1-1/e$ barrier. Those results, however, do no hold for the more general online stochastic weighted matching problem. Moreover, all of these results employ the idea of power of two choices. In this paper, we present the first approximation (0.667-competitive) algorithm for the online stochastic weighted matching problem beating the $1-1/e$ barrier. Moreover, we improve the approximation factor of the online stochastic matching by analyzing the more general framework of power of multiple choices. In particular, by computing a careful third pseudo-matching along with the two offline solutions, and using it in the online algorithm, we improve the approximation factor of the online stochastic matching for any bipartite graph to 0.7036.

Keywords: online stochastic matching; approximation algorithm; competitive analysis; ad allocation
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